



# Drosophilid flies (Diptera: Drosophilidae) of Georgia (Sakartvelo) with new records for the country

Maka Murvanidze<sup>1</sup>, George Japoshvili<sup>2</sup>, Nino Inasaridze<sup>1</sup>, Ferenc Deutsch<sup>3</sup>

<sup>1</sup> I. Javakishvili Tbilisi State University, I. Chavchavadze ave. 1. 0179 Tbilisi, Georgia

<sup>2</sup> Institute of Entomology, Agricultural University of Georgia, 240, D. Aghmashenebeli Alley, Tbilisi – 0131, Georgia

<sup>3</sup> Centre for Agricultural Research, Plant Protection Institute, ELKH, Herman Ottó út 15. 1022, Budapest, Hungary

<http://zoobank.org/16E06BF8-FB60-4B62-8EE7-73C88F7EFD31>

Corresponding author: Maka Murvanidze (maka.murvanidze@tsu.ge)

**Academic editor:** Ximo Mengual ♦ **Received:** 1 June 2022 ♦ **Accepted:** 12 September 2022 ♦ **Published:** 25 October 2022

## Abstract

Four genera and 12 species of drosophilid flies have been recorded during our survey in five regions of Georgia in 2021. Two genera, *Amiota* (Loew, 1862) and *Gitona* Meigen, 1830, and four species (*Amiota subtusradiata* Duda 1934, *Drosophila busckii* Coquillett 1901, *D. kuntzei* Duda, 1924, and *Gitona distigma* Meigen, 1830) represent new records for the fauna of Georgia (Sakartvelo).

## Key words

*Drosophila suzukii*, Invasive, Pest, Inventory

## Introduction

Drosophilidae is a family within the order Diptera, comprising 100 genera and 4473 species worldwide (Bánki et al. 2022). This group of insects is extremely understudied in the Caucasian Region (Gornostaev 1997), one of the globally important biodiversity hotspots (Myers et al. 2000; Williams et al. 2006). In their recent study about the Diptera of Georgia and Azerbaijan, Oboňa et al. (2019) summarized the existing information about the drosophilids in the Caucasus and indicated the presence of only eight species in Georgia belonging to five genera, i.e., *Drosophila immigrans* Sturtevant, 1921, *D. simulans* Sturtevant, 1919, *D. suzukii* (Matsumura, 1931), *D. testacea* von Roser, 1840, *Leucophenga maculata* (Dufour, 1839), *Lordiphosa hexasticha* (Papp, 1971), *Scaptomyza graminum* (Fallén, 1823), and *Zaprionus tuberculatus* Malloch, 1932.

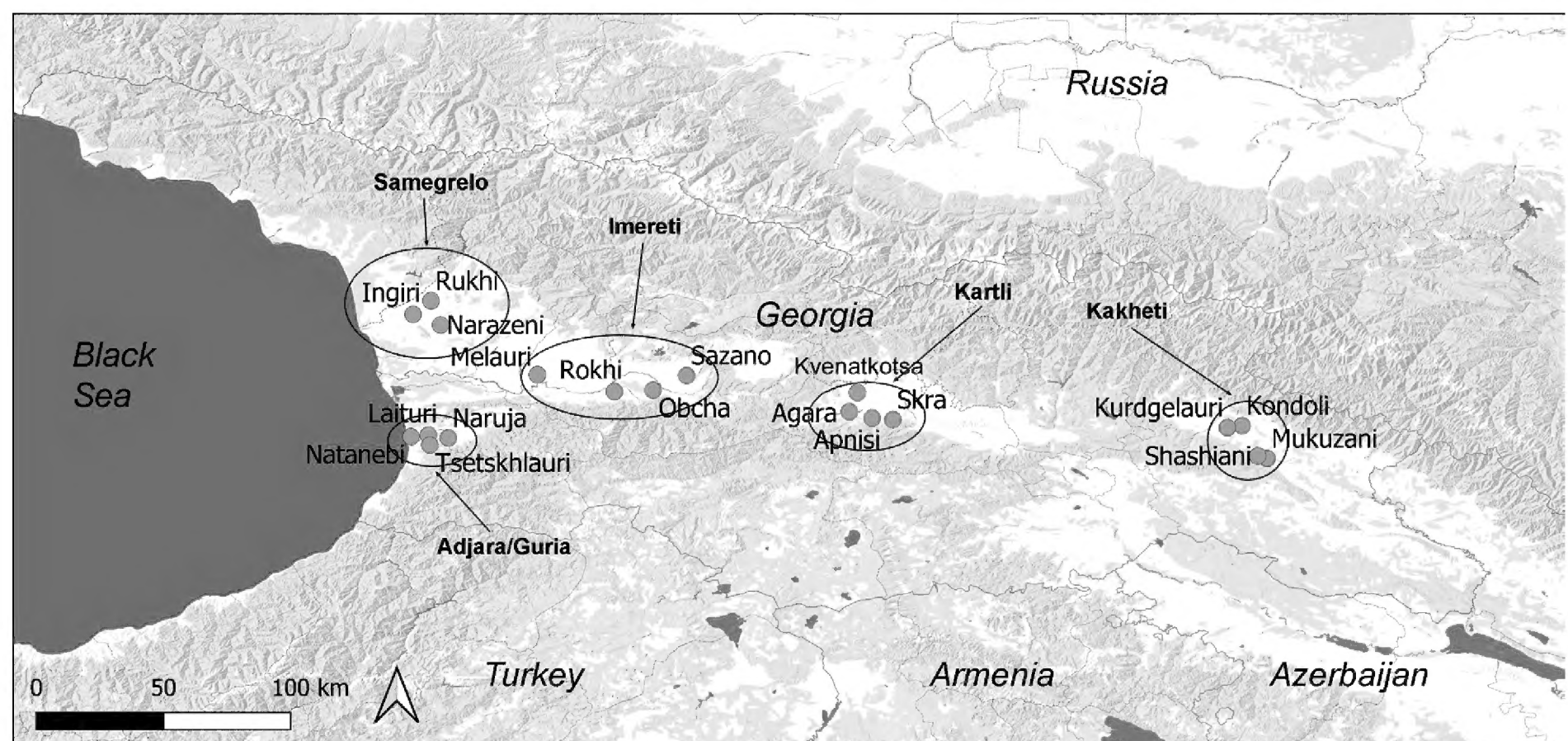
*Drosophila suzukii*, one of the major fruit pest species world-wide, was first recorded in Georgia in 2017 (Japoshvili et al. 2018). In 2022, a countrywide monitoring project was initiated by the USAID Georgian Agriculture program and the National Food Agency of Georgia aiming to in-

vestigate the distribution of this invasive pest species, also known as the spotted wing drosophila (SWD). Along with the representatives of the target taxon, other drosophilid flies were also recorded. Monitoring was carried out in major agricultural regions of Georgia in orchards of susceptible crops to *D. suzukii* such as blueberries, strawberries, cherries, and grapes (Lee et al. 2012; Walsh et al. 2011). In the present work, we report the results of our findings with the updated data about the drosophilid diversity in Georgia and the new records for the country.

## Material and methods

### Study area

Study sites were distributed in the Adjara/Guria, Samegrelo, Imereti, Kartli, and Kakheti regions in order to cover the key host crop production areas for the SWD across Georgia. In each of these five regions, four monitoring sites of 2 hectares each were established with an in-between minimal distance of 5 km (Fig. 1, Table 1).



**Figure 1.** A map of Georgia showing the distribution of study sites (red dots).

## Trap placement and monitoring

In the monitoring sampling, PHEROCON® SWD traps with PHEROCON® SWD PEEL-PAK™ Broad Spectrum Lures (Trécé, Inc., Adair, OK, USA) were used from May to November 2021. Five traps were placed at each site, with four traps placed at the edges and one in the middle of the field as prescribed by the producer, with a distance between the traps of about 130 m. Traps were placed in the shaded areas of the host plant canopy and were checked for the presence of drosophilid flies once a week. Captured flies were extracted from traps using a fine paintbrush and stored in 95% alcohol for further treatment. Lures in each trap were changed once a month as prescribed by the producer company.

## Laboratory procedures

Sampled flies were preliminary examined in the laboratory using a stereomicroscope UNITRON Z850 for identification. After identification, the voucher specimens were preserved in 70% ethanol and deposited at the laboratory of the Agricultural University of Georgia.

The Drosophilid flies were subsequently identified by the last author using a stereomicroscope OLYMPUS SZ61 and the identification keys by Papp (1973) and Bächli et al. (2004). Specimens were also compared with the Diptera collection of the Hungarian Natural History Museum for species confirmation.

## Results

A total of 12 species of drosophilid flies were sampled during the monitoring, belonging to four genera (Supplementary file 1: Table S1). An asterisk (\*) in the species list indicates new records for the country. The number of the collected specimens is not indicated.

Samples were collected primarily thanks to the student helpers, whose names are indicated under each species as

the following abbreviations: LJ-Luka Janjghava, KB-Konstantine Buchukuri, AK-Ani Kiria, SN-Sandro Narsia, MB-Mariam Beridze, SK-Salome Kalandadze, NM-Nana Mamulaishvili, NT-Nino Tkeshelashvili, LM-Lana Makalashvili, KA-Khatia Areshidze, AA-Ana Amonashvili, MA-Mariam Aleksidze,

## List of species

### Family Drosophilidae Rondanin, 1856

Genus *Amiota* (Loew, 1862)\*

*Amiota subtusradiata* Duda, 1934\*

- GEORGIA • Narazeni; 15-Jul-2021; leg: AK, SN.
- Distribution: Palearctic.

Genus *Drosophila* Fallén, 1823

*Drosophila busckii* Coquillett, 1901\*

- GEORGIA • Melauri; 15-Jul-2021; leg: NT, KA, LM. Apnisi; 29-May-2021; leg: LJ, KB.
- Distribution: Cosmopolitan.

*D. immigrans* Sturtevant, 1921

- GEORGIA • Melauri; 18-Jun-2021; leg: NT, KA, LM. Melauri; 15-Jul-2021; leg: NT, KA, LM. Sazano; 15-Jul-2021; leg: NT, KA, LM. Kondoli; 15-Aug-2021; leg: AA, MA, MO. Shashiani; 15-Aug-2021; leg: AA, MA, MO.
- Distribution: Cosmopolitan. Previous records in Georgia from Imereti region, Khanistskali River (Obona et al. 2019).

*D. kuntzei* Duda, 1924\*

- GEORGIA • Melauri; 15-Jul-2021; leg: NT, KA, LM. Kurdgelauri; 05-Jun-2021; leg: AA, MA, MO.
- Distribution: Palearctic.

*D. melanogaster* Meigen, 1830

- GEORGIA • Naruja; 18-Jul-2021; leg: MB, SK, NM. Ingiri; 15-Jul-2021; leg: AK, SN. Skra; 08-Sep-2021; leg: LJ, KB. Mukuzani; 15-Aug-2021; leg: AA, MA, MO. Kondoli; 15-Aug-2021; leg: AA, MA, MO.

**Table 1.** List of the study sites with GPS coordinates and key crops where spotted wing *Drosophila* (SWD) traps were operated.

Region	Local names of study sites	GPS coordinates	Key crop
Adjara	Laituri	N41.91791° E41.86744°	Blueberry
	Naruja	N41.90494° E41.95854°	Blueberry
	Natanebi	N41.91013° E41.78736°	Strawberry
Imereti	Tsetskhlauri	N41.87187° E41.87377°	Blueberry
	Melauri	N42.19397° E42.36720°	Strawberry
	Obcha	N42.12369° E42.89659°	Vineyard
	Rokhi	N42.11675° E42.72013°	Vineyard
	Sazano	N42.19081° E43.05072°	Vineyard
Kakheti	Kondoli	N41.96077° E45.59670°	Vineyard
	Kurdgelauro	N41.95217° E45.52922°	Vineyard
	Mukuzani	N41.81078° E45.71103°	Vineyard
	Shashiani	N41.82243° E45.66798°	Strawberry
Kartli	Agara	N42.02488° E43.79655°	Strawberry
	Apnisi	N41.99563° E43.90088°	Cherry
	Kvenatkotsa	N42.04503° E 43.83134°	Cherry
	Skra	N41.98841° E43.99599°	Cherry
Samegrelo	Ingiri	N42.47177° E41.79704°	Blueberry
	Narazeni	N42.42246° E41.92330°	Blueberry
	Rukhi	N42.53401° E41.87925°	Blueberry

- Distribution: Cosmopolitan. According to the Georgian biodiversity database (GBD), the species is known from Georgia. However, the occurrence was not checked by experts and the previous records can be considered doubtful (Tarkhnishvili and Chaladze 2013).

*D. phalerata* Meigen, 1830\*

- GEORGIA • Melauri; 15-Jul-2021; leg: NT, KA, LM. Shashiani; 05-Jun-2021; leg: AA, MA, MO

- Distribution: Europe.

*D. simulans* Sturtevant, 1919

- GEORGIA • Naruja; 20-Sep-2021; leg: MB, SK, NM. Sazano; 15-Jul-2021; leg: NT, KA, LM. Kondoli; 15-Aug-2021; leg: AA, MA, MO. Shashiani; 15-Aug-2021; leg: AA, MA, MO. Kurdgelauro; 25-Sep-2021; leg: AA, MA, MO.

- Distribution: Cosmopolitan. Previous records in Georgia from Imereti (Ghvedi, Tsablaraskhevi River) and Shida Kartli Regions (Oboňa et al. 2019).

*D. subobscura* Collin, 1936

- GEORGIA • Apnisi; 29 May 2021; leg: LJ, KB. Shashiani; 15-Aug-2021; AA, MA, MO.
- Distribution: According to the GBD, this species is known from Georgia. However, the records were not checked by experts, and the occurrence might be doubtful (Tarkhnishvili and Chaladze 2013).

*D. suzukii* (Matsumura, 1931)

- GEORGIA • Laituri; 07-Jul-2021; leg: MB, SK, NM. Naruja; 07-Jul-2021; leg: MB, SK, NM. Natanebi; 07-Jul-2021; leg: MB, SK, NM. Tsetskhlauri; 11-Jul-2021; leg: MB, SK, NM. Melauri; 18-Jun-2021; leg: NT, KA, LM. Obcha; 22-Jul-2021; leg: NT, KA, LM. Rokhi; 02-Jul-2021; leg: NT, KA, LM. Sazano; 02-Jul-2021; leg: NT, KA, LM. Kondoli; 15-Aug-2021; leg: AA, MA, MO. Kurdgelauro; 04-Jul-2021; leg: AA, MA, MO. Mukuzani; 04-Jul-2021; leg: AA, MA, MO. Shashiani; 27-Jun-2021; leg: AA, MA, MO. Agara; 24-Oct-2021; leg: LJ, KB. Apnisi; 12-Jul-2021; leg: LJ, KB. Kvenatkotsa; 20-Sep-2021; leg: LJ, KB. Skra;

07-Aug-2021; leg: LJ, KB. Ingiri; 15-May-2021; leg: AK, AN. Narazeni; 13-Jun-2021; leg: AK, AN. Rukhi; 20-Jun-2021; leg: AK, AN.

- Distribution: Cosmopolitan (Walsh et al. 2011). Previous records from Georgia are from: Batumi (Japoshvili et al. 2018), Imereti (Ghvedi), Racha-Lechkhumi and Kvemo Svaneti Regions (Tskhenistskali River near Durashi, and Tskhenistskali River near Makhashi) (Oboňa et al. 2019).

*D. testacea* von Roser, 1840

- GEORGIA • Naruja; 18-Jul-2021; leg: MB, SK, NM. Laituri; 18-Jul-2021; leg: MB, SK, NM. Melauri; 15-Jul-2021; leg: NT, KA, LM. Obcha; 15-Jul-2021; leg: NT, KA, LM. Rokhi; 09-Jun-2021; leg: NT, KA, LM. Apnisi; 29-May-2021; leg: LJ, KB. Kurdgelauro; 05-Jun-2021; leg: AA, MA, MO. Mukuzani; 15-Aug-2021; leg: AA, MA, MO. Kondoli; 15-Aug-2021; leg: AA, MA, MO.

- Distribution: Palearctic (Oboňa et al. 2019). Species previously recorded from Kvemo Svaneti (Tskhenistskali River near Durashi) and Racha-Lechkhumi Regions (Oboňa et al. 2019).

Genus *Gitona* Meigen, 1830\*

*Gitona distigma* Meigen, 1830\*

- GEORGIA • Apnisi; 10-Aug-2021; leg: LJ, KB.
- Distribution: Palearctic.

Genus *Zaprionus* Coquillett, 1901

*Z. tuberculatus* Malloch, 1932

- GEORGIA • Naruja; 20-Sep-2021; leg: MB, SK, NM.
- Distribution: Afrotropical and Mediterranean (Oboňa et al. 2019). Previous records from Georgia were from Imereti Region (Ghvedi, Khanistskali River) (Oboňa et al. 2019)

Conclusion

Based on our investigation and literature data, 15 species currently represent the drosophilid fauna of Georgia. Our findings confirmed the presence of five species previously recorded in Georgia but could not recover the other three taxa, namely *Leucophenga maculata* (Dufour, 1839), *Lordiphosa hexasticha* (Papp, 1971), and *Scaptomyza graminum* (Fallén, 1823), recorded by Oboňa et al. (2019). Moreover, four species were added to the regional drosophilid fauna, i.e., *Amiota subtsuradiata*, *Drosophila busckii*, *D. kuntzei* and *G. distigma*, and the invasive pest species *D. suzukii* was found in all major agricultural regions of Georgia.

Acknowledgements

The authors would like to express their gratitude to the US-AID agricultural program and its lead Dr. Louisa Nami-cheishvili for funding this project, the company Trécé, Inc., its president Bill Lindgren and Dr. Danielle Kirkpatrick for granting the monitoring traps and consulting, the Georgian National Food Agency and the head of the department of



plant protection Dr. Nikoloz Meskhi for overall support of the project. We also would like to thank to the students of I. Javakhishvili Tbilisi State University (Luka Janjghava, Konstantine Buchukuri, Ani Kiria), Agricultural University of Georgia (Sandro Narsia), Batumi State University (Mariam Beridze, Salome Kalandadze, Nana Mamulaishvili), Kutaisi State University (Nino Tkeshelashvili, Lana Makalatia, Khatia Areshidze), Telavi State University (Ana Amonashvili, Mariam Aleksidze, Mariam Onikashvili) and their supervisors (Dr. Lali Jgenti, Dr. Maka Khetsuriani, Dr. Magda Davitashvili) for participation in the field works. We also express our gratitude to anonymous reviewers and Dr. Ximo Mengual and Dr. Levan Mumladze for revising the text and providing valuable comments.

## References

- Bánki O, Roskov Y, Döring M, Ower G, Vandepitte L, Hobern D, Remsen D, Schalk P, DeWalt RE, Keping M, Miller J, Orrell T, Aalbu R, Adlard R, Adriaenssens EM, Aedo C, Aescht E, Akkari N, Alfenas-Zerbini P, et al. (2022) Catalogue of Life Checklist (Version 2022-03-21). Catalogue of Life.
- Bächli G, Vilela CR, Escher AS, Saura A (2004) The Drosophilidae (Diptera) of Fennoscandia and Denmark. *Fauna Entomologica Scandinavica* 39: 1–362. <https://doi.org/10.1163/9789047414681>
- Gornostaev NG (1997) An addition to the fauna of drosophilid flies (Diptera, Drosophilidae) of Middle Asia, Kazakhstan and Transcaucasia. *Russian Entomological Journal* 5(1–4): 163–166.
- Lee JC, Bruck DJ, Dreves AJ, Ioriatti C, Vogt H, Baufeld P (2011) In Focus: Spotted wing drosophila, *Drosophila suzukii*, across perspectives. *Pest Management Science* 67: 1349–1351. <https://doi.org/10.1002/ps.2271>
- Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J (2000) Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858. <https://doi.org/10.1038/35002501>
- Oboňa J, Dvořák L, Haenni JP, Hrivniak L, Japoshvili B, Ježek J, Kerimova I, Maca J, Muranyi D, Rendoš M, Słowińska I, Snegovaya I, Sary J, Manko P (2019) New and interesting records of Diptera from Azerbaijan and Georgia. *Zoosystematica Rossica* 28(2): 277–295. <https://doi.org/10.31610/zsr/2019.28.2.277>
- Papp L (1973) Trágyalegyek – harmatlegyek – Sphaeroceridae – Drosophilidae. *Magyarország Állatvilága* 15(7) füzet. Diptera II, 145 pp.
- Walsh DB, Bolda MP, Goodhue RD, Dreves AJ, Lee J, Bruck DJ, Walton VM, O’Neal SD, Zalom FG (2011) *Drosophila suzukii* (Diptera: Drosophilidae): Invasive pest of ripening soft fruit expanding its geographic range and damage potential. *Journal of Integrative Pest Management* 2(1): 1–7. <https://doi.org/10.1603/IPM10010>
- Tarkhnishvili D, Chaladze G (2013) Georgian biodiversity database. <http://www.biodiversity-georgia.net/> [Accessed 14 April 2022]
- Williams L, Zazanasahvili N, Sanadiradze G, Kandaurov A (2006) An ecoregional conservation plan for the Caucasus. WWF Caucasus Programme Office. Tbilisi, 220 pp.

## Supplementary material

### Table S1. Presence/absence data of drosophilid flies (Diptera: Drosophilidae) in Georgia

**Authors:** Maka Murvanidze, George Japoshvili, Nino Inasaridze, Ferenc Deutsch

**Data type:** .xlsx

**Copyright notice:** This dataset is made available under the Open Database License (<http://opendatacommons.org/licenses/odbl/1.0>). The Open Database License (ODbL) is a license agreement intended to allow users to freely share, modify, and use this Dataset while maintaining this same freedom for others, provided that the original source and author(s) are credited.

**Link:** <https://doi.org/10.3897/caucasiana.1.e87258.suppl1>